Kirk D. Williams, Reg. No. 42,229, Docket No. 15654
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ASSOCIATIVE
MEMORY
100

PROGRAMMING,
LOOKUP SIGNALS

110

BLOCK MASK - 1 — 111

ASSOCIATIVE MEMORY ENTRIES - 1

112

120

BLOCK MASK - 2 — 121

ASSOCIATIVE MEMORY ENTRIES - 2

122

BLOCK MASK - N — 131

130

ASSOCIATIVE MEMORY ENTRIES - N

132

140

RESULTS

PRIORITY
ENCODER

PRIOR ART
FIGURE 1A

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ORDER OF
PRECEDENCE

150 ⬊ **ACL-1**

| ACL ENTRIES WITH MASK A |
| ACL ENTRIES WITH MASK B |
| ACL ENTRIES WITH MASK C |
| ACL ENTRIES WITH MASK D |

ACL-2 ⬋ 152

| ACL ENTRIES WITH MASK D |
| ACL ENTRIES WITH MASK B |
| ACL ENTRIES WITH MASK C |
| ACL ENTRIES WITH MASK A |

PROGRAMMING IN ASSOCIATIVE
MEMORY WITH BLOCK MASK

155 ⬊

| BLOCK 1 MASK = A |
| BLOCK 2 MASK = B |
| BLOCK 3 MASK = C |
| BLOCK 4 MASK = D |
| BLOCK 5 MASK = D |
| BLOCK 6 MASK = B |
| BLOCK 7 MASK = C |
| BLOCK 8 MASK = A |

156 ⬊

| BLOCK 1 MASK = A |
| BLOCK 2 MASK = B |
| BLOCK 3 MASK = C |
| BLOCK 4 MASK = D |
| BLOCK 5 MASK = B |
| BLOCK 6 MASK = C |
| BLOCK 7 MASK = A |

157 ⬊

| BLOCK 1 MASK = D |
| BLOCK 2 MASK = B |
| BLOCK 3 MASK = C |
| BLOCK 4 MASK = A |
| BLOCK 5 MASK = B |
| BLOCK 6 MASK = C |
| BLOCK 7 MASK = D |

PRIOR ART
FIGURE 1B

Kirk D. Williams, Reg. No. 42,229, Docket No. 15654
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FIGURE 2A

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FIGURE 2B

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ACL-1
201

COST
ARRAY
200

	0	A	B	C	D
0	0	1	2	3	4
D	1	2	3	4	4
B	2	3	3	4	5
C	3	4	4	4	5
A					

ACL-2
202

+1

5 ⟵ 213

+1

DIFFERENT MASKS (C &D)
SO, TAKE THE LESSER OF
THE TWO SUMS

FIGURE 2C

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		ACL-1 201			
	0	**A**	**B**	**C**	**D**
0	0	1	2	3	4
D	1	2	3	4	4
B	2	3	3	4	5
C	3	4	4	4	5
A	4	4	5	5	6

COST ARRAY 200

ACL-2 202

FIGURE 2D

Kirk D. Williams, Reg. No. 42,229, Docket No. 15654

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ACL-1
201

COST
ARRAY
200

	0	A	B	C	D
0	(0)←X—(1)		2	3	4
D	1	(2)←A—(3)	4	4	
B	2	3	(3)	4	5
C	3	4	(4)←B—(4)←C—(5)		
A	4	4	5	5	(6) 260

ACL-2
202

X

X

D

B

C

(A,D)

261

RESULTANT
MASK
ORDER:

A   A
D   D
B OR B
C   C
A   D
D   A

FIGURE 2E

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FIGURE 2F

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ACL-1
301

COST
ARRAY
300

	0	A	B	C	D	D
0	0 (0,0)	1 (1,0)	2 (1,0)	3 (1,0)	4 (1,0)	4 (2,0)
D	1 (0,1)	2 (1,0)	3 (1,0)	4 (1,0)	4 (1,1)	4 (1,2)
B	2 (0,1)	3 (1,0)	3 (1,1)	4 (1,0)	5 (1,0)	5 (0,1)
C	3 (0,1)	4 (1,0)	4 (0,1)	4 (1,1)	5 (1,0)	5 (2,0)
A	4 (0,1)	4 (1,1)	5 (1,0)	5 (0,1)	6 (1,0)	6 (0,1)

ACL-2
302

FIGURE 3A

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FIGURE 3B

Kirk D. Williams, Reg. No. 42,229, Docket No. 15654
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FIGURE 3C

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START 400

402
IDENTIFY A REQUIRED ORDERING OF MASKS
FOR EACH OF THE PLURALITY OF ACLS.

404
GENERATE AN N-DIMENSIONAL ARRAY WHEREIN EACH AXIS
OF THE N-DIMENSIONAL ARRAY CORRESPONDS TO A
DIFFERENT ONE OF THE PLURALITY OF ACLS, THE N-
DIMENSIONAL ARRAY PROGRESSIVELY IDENTIFYING
NUMBERS OF DIFFERENT MASKS REQUIRED FOR SUBSET
ORDERINGS OF MASKS REQUIRED FOR SUBSETS OF THE
PLURALITY OF ACLS. ONE EMBODIMENT MAINTAINS
INDICATIONS FROM WHERE THE NUMBERS OF DIFFERENT
MASKS REQUIRED ARE DERIVED.

406
TRAVERSE THE N-DIMENSIONAL ARRAY TO IDENTIFY A
SEQUENCE OR A REVERSE SEQUENCE OF MASKS
CORRESPONDING TO A SINGLE ORDERING OF MASKS
INCLUDING MASKS REQUIRED FOR EACH OF THE PLURALITY
OF ACLS, WHEREIN THE SINGLE ORDERING OF MASKS
MAINTAINS THE ORDERING OF MASKS REQUIRED FOR EACH
OF THE PLURALITY OF ACLS WITH ONE OR MORE MASKS
CORRESPONDING TO A DIFFERENT ACL OR OTHER FEATURE
IN BETWEEN ONE OR MORE CONSECUTIVE MASKS OF AN
ACL OF THE PLURALITY OF ACLS. ONE EMBODIMENT
TRAVERSES THE ARRAY BASED ON SAID NUMBERS OF
DIFFERENT MASKS REQUIRED FOR SUBSET ORDERINGS OF
MASKS REQUIRED FOR SUBSETS OF THE PLURALITY OF
ACLS. ONE EMBODIMEMNT TRAVERSES THE ARRAY BASED
ON SAID INDICATIONS FROM WHERE THE NUMBERS OF
DIFFERENT MASKS REQUIRED ARE DERIVED.

408
POPULATE BLOCK MASKS OF AN
ASSOCIATIVE MEMORY WITH THE MASKS OF
THE ASSOCIATIVE MEMORIES SUCH THAT
THEY ARE IN THE DETERMINED ORDER

END 410

FIGURE 4A

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START — 440

442

IDENTIFY A FIRST ORDERING OF MASKS REQUIRED FOR THE FIRST ACL AND A SECOND ORDERING OF MASKS REQUIRED THE SECOND ACL.

444

GENERATE A MATRIX OF THE FIRST AND SECOND ORDERINGS OF MASKS, THE MATRIX PROGRESSIVELY IDENTIFYING NUMBERS OF DIFFERENT MASKS REQUIRED FOR SUBSET ORDERINGS OF MASKS REQUIRED FOR SUBSETS OF THE FIRST AND SECOND ACLS. ONE EMBODIMENT MAINTAINS INDICATIONS FROM WHERE THE NUMBERS OF DIFFERENT MASKS REQUIRED ARE DERIVED.

446

TRAVERSE THE MATRIX TO IDENTIFY A SEQUENCE OR A REVERSE SEQUENCE OF MASKS CORRESPONDING TO A SINGLE ORDERING OF MASKS INCLUDING MASKS REQUIRED FOR THE FIRST ACL AND THE SECOND ACL, WHEREIN THE SINGLE ORDERING OF MASKS MAINTAINS THE FIRST ORDERING AND SECOND ORDERINGS OF MASKS WITH ONE OR MORE MASKS CORRESPONDING TO A DIFFERENT ACL OR OTHER FEATURE IN BETWEEN ONE OR MORE CONSECUTIVE MASKS OF THE FIRST AND SECOND ACLS. ONE EMBODIMENT TRAVERSES THE MATRIX BASED ON SAID NUMBERS OF DIFFERENT MASKS REQUIRED FOR SUBSET ORDERINGS OF MASKS REQUIRED FOR SUBSETS OF THE FIRST AND SECOND ACLS. ONE EMBODIMENT TRAVERSES THE MATRIX BASED ON SAID INDICATIONS FROM WHERE THE NUMBERS OF DIFFERENT MASKS REQUIRED ARE DERIVED.

448

POPULATE BLOCK MASKS OF AN ASSOCIATIVE MEMORY WITH THE MASKS OF THE ASSOCIATIVE MEMORIES SUCH THAT THEY ARE IN THE DETERMINED ORDER

END — 450

FIGURE 4B

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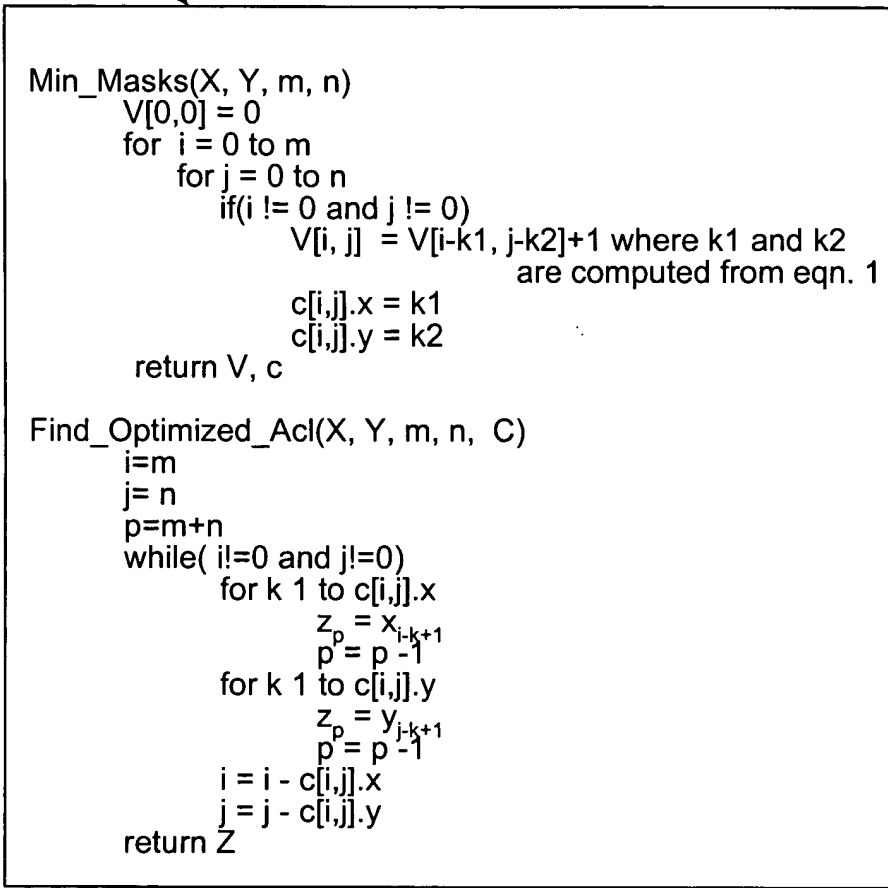
PSEUDO-CODE
500

```
Min_Masks(X, Y, m, n)
      V[0,0] = 0
      for  i = 0 to m
            for j = 0 to n
                  if(i != 0 and j != 0)
                        V[i, j]  = V[i-k1, j-k2]+1 where k1 and k2
                                            are computed from eqn. 1
                        c[i,j].x = k1
                        c[i,j].y = k2
      return V, c

Find_Optimized_Acl(X, Y, m, n,  C)
      i=m
      j= n
      p=m+n
      while( i!=0 and j!=0)
            for k 1 to c[i,j].x
                  z_p = x_{i-k+1}
                  p = p -1
            for k 1 to c[i,j].y
                  z_p = y_{j-k+1}
                  p = p -1
            i = i - c[i,j].x
            j = j - c[i,j].y
      return Z
```
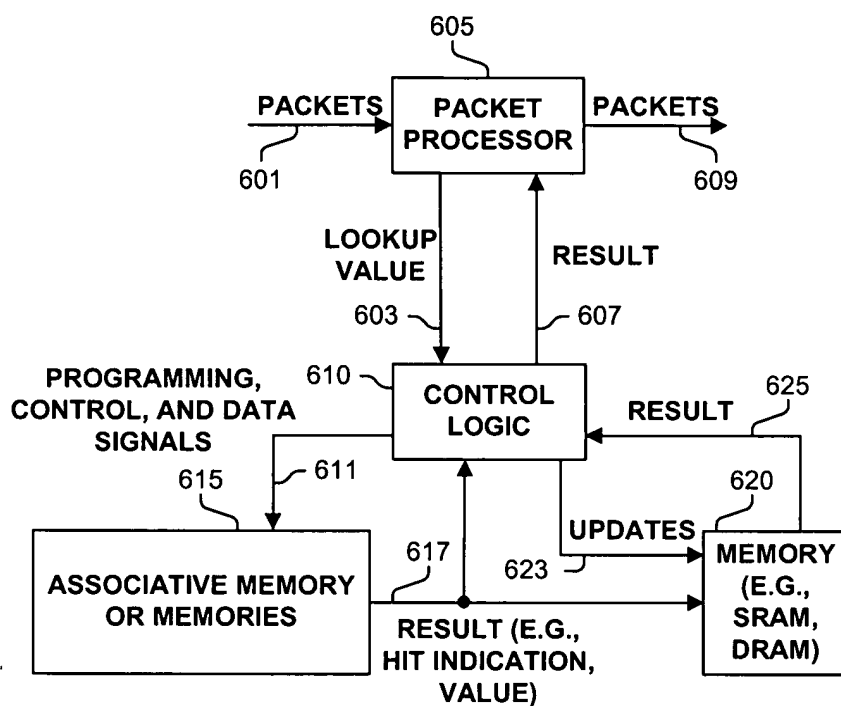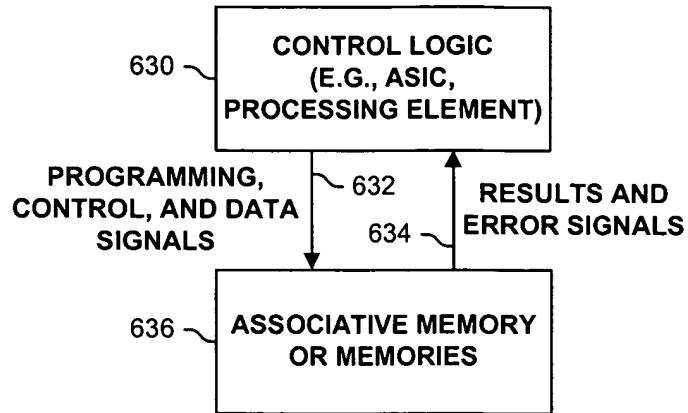
FIGURE 5

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605

PACKETS → | PACKET PROCESSOR | → PACKETS

601   609

LOOKUP VALUE   RESULT

603   607

PROGRAMMING,   610
CONTROL, AND DATA | CONTROL LOGIC | RESULT   625
SIGNALS

615   611   620

| ASSOCIATIVE MEMORY OR MEMORIES | 617   623   UPDATES | MEMORY (E.G., SRAM, DRAM) |

RESULT (E.G., HIT INDICATION, VALUE)

FIGURE 6A

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630 — CONTROL LOGIC
(E.G., ASIC,
PROCESSING ELEMENT)

PROGRAMMING,
CONTROL, AND DATA
SIGNALS

632

634

RESULTS AND
ERROR SIGNALS

636 — ASSOCIATIVE MEMORY
OR MEMORIES

FIGURE 6B

682

681

SYSTEM
680

MEMORY
(INSTRUCTIONS / DATA)

PROCESSING
ELEMENT

689

STORAGE DEVICES
(INSTRUCTIONS / DATA)

ASSOCIATIVE
MEMORY OR
MEMORIES

INTERFACE

683

684

685

FIGURE 6C